

A BIOLOGICAL EVALUATION OF IPS BARK BEETLE  
INFESTATIONS OCCURRING AT THE AVON PARK AIR  
FORCE RANGE, AVON PARK, FLORIDA

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by

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ABSTRACT

An evaluation of Ips bark beetle infestations at Avon Park Air Force Range, showed that Ips bark beetle populations have increased as a result of a wildfire in a 15 year old slash pine plantation. Ips calligraphus, Ips grandicollis, and Ips avulsus were found with I. calligraphus being the predominant species. Drought conditions are also playing an important role in the buildup of the Ips populations.

INTRODUCTION

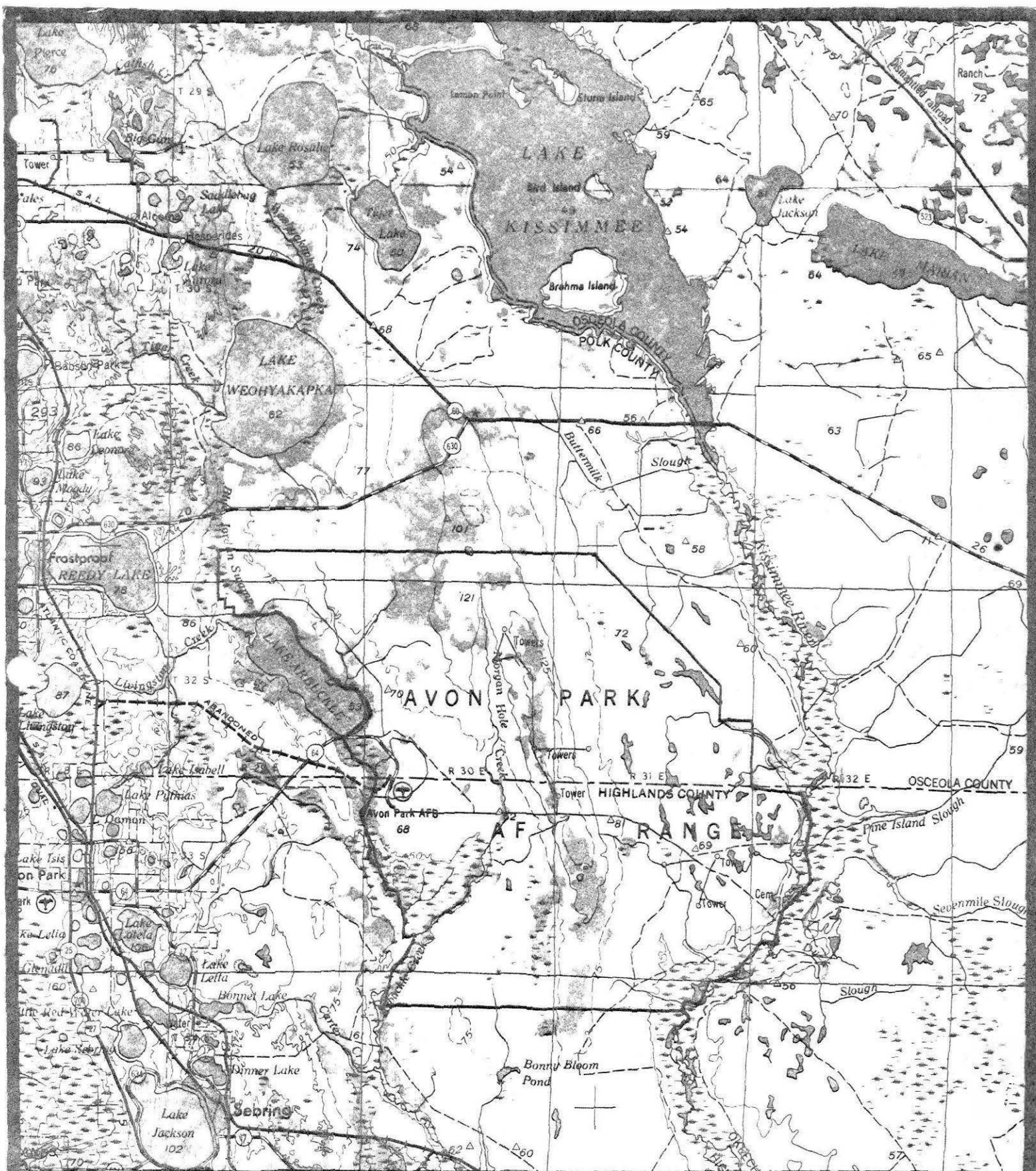
Avon Park Air Force Range is located in the central portion of Florida just east of Avon Park (Figure 1). Encompassing 106,210 acres, this range has been in existence since 1941. Used as a bombing and artillery range, this Air Force facility is one of only two active Air Force ranges in the eastern United States. In addition to the military mission of the Avon Park Range, recreation, cattle grazing, and timber production are important components of the land management plan.

Sand pine (Pinus clausa), pond pine (Pinus serotina), longleaf pine (Pinus palustris), typical slash pine (Pinus elliottii) and south Florida slash pine (Pinus elliottii var. densa) occupy the 60,000 acres of pine habitat on the range. There are approximately 20,000 acres of pine plantations under intensive silvicultural management.

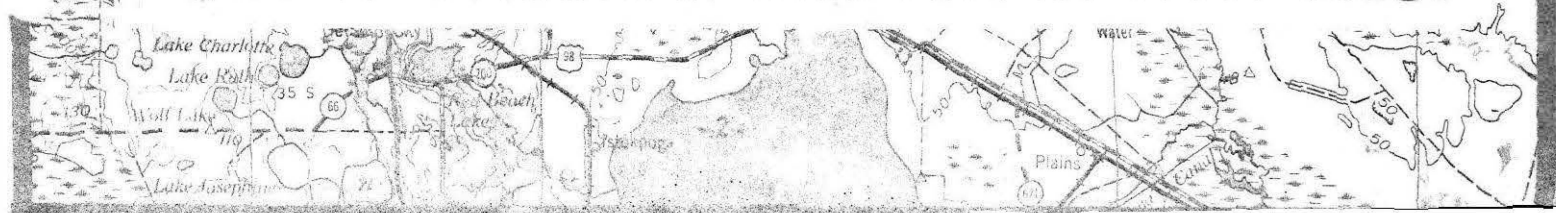
A summer wildfire severely damaged 285 acres of a 15 year old typical slash pine plantation. Many pines damaged in this fire have been attacked by Ips beetles. Because of the potential for continuing bark beetle damage, personnel from the range requested the assistance of the USDA Forest Service, Forest Pest Management group. This evaluation is the result of observations made on October 20 and 21, 1981.

IPS BEETLE BIOLOGY

Ips beetles (or pine engraver beetles) belong to the family Scolytidae. These insects prefer to attack pines weakened by stress factors such as soil compaction, storm damage, drought, and fire. Three common species of Ips occur in the Avon Park area: Ips avulsus (about 2.5mm in length), Ips grandicollis (about 3.8mm in length), and Ips calligraphus (about 5.0mm in length). Ips beetles prefer to attack material proportionate to their size with I. avulsus usually found in the tops



**Figure 1.--Location of Avon Park Air Force Range**



of trees and smaller branches, I. grandicollis in the middle bole, and I. calligraphus nearer the tree base.

Male beetles initiate attacks on the trees. If enough resin is present in the trees, pitch tubes (globs of resin and boring dust) form at the points of attack. Under conditions of low tree moisture, red boring dust may be the only external evidence of attack. Once beneath the bark and in the cambium of the tree, males excavate nuptial chambers (mating chambers) and release a sex attractant. Three to five females normally respond to the attractant of each attacking male. After mating, females construct galleries radiating out from the nuptial chamber where they lay eggs between the bark and the wood. These galleries normally run parallel with the wood grain. Typically, this pattern imparts a "Y" or "H" design on the wood surface and inner bark. Ips beetles also transmit a blue stain fungus, Ceratocystis ips, which helps kill the trees by plugging the conductive tissues. Upon hatching, the wormlike larvae mine outward from the egg gallery and terminate their mines with pupal cells where they change to adults and emerge directly through the bark (Baker, 1972). This results in the destruction of the cambium layer and the death of the tree. Trees from which Ips beetles have emerged appear as if shot with a scattergun.

There may be 6 to 10 or more generations per year depending on species, season, climate, and amount of rainfall. Under optimum developmental conditions, a generation can be completed in about three weeks.

Normally, Ips beetles pose little threat to healthy timber, but if a large volume of stressed timber is infested, high populations may develop that force successful attacks on adjacent, apparently vigorous trees.

#### DISCUSSION

As a result of the wildfire, many pines have been killed or damaged. In addition to the fire, drought conditions continue to exist throughout the region. The combination of these factors have severely stressed the trees and provided the conditions necessary for the rapid build-up of Ips populations. Many of the fire damaged trees have been attacked and successfully colonized by these insects. As the Ips populations have increased, trees which suffered minimal fire damage have also been attacked and killed by the beetles. From our observations, we conclude that the current infestation will continue until most of the fire damaged timber has been killed. Small numbers of apparently healthy, undamaged trees in close proximity to the burned area may also be attacked and killed by Ips beetles. The infestation will gradually diminish in intensity as cooler weather prevails, drought conditions cease, and natural parasite and predator populations increase.

#### RECOMMENDATIONS

Following are listed options for dealing with the current Ips bark beetle infestation occurring at Avon Park Air Force Range.

## A. Direct Control Options

### 1. Pile and burn infested trees

All trees should be felled toward the center of the infestation. Tree boles, as well as slash and any infested bark, should be piled in a central area away from uninfested pines and burned until the bark is well charred.

### 2. Solar radiation exposure

For use when the average daytime temperature is 80° or greater.

a. Direct exposure method - all infested trees should be felled with the boles in a north-south orientation and spread out for optimum exposure to direct sunlight. The trees should be turned after five days so that all surfaces receive exposure to direct sunlight. This method results in a significant build-up of heat beneath the bark, which destroys developing brood.

b. Greenhouse effect method - all infested trees should be felled toward the center of the infestation. Trees may be bucked, piled along with the tops, and then covered by heavy gauge clear polyethylene sheeting. The sheeting should be of sufficient gauge to resist tearing and should be securely anchored to the ground. The plastic traps and holds the heat, which kills the developing brood. Polyethylene sheeting should remain intact for 30 days (Buffam, 1968).

### 3. Debarking

Trees should be felled and debarked. All bark should be burned to insure destruction of any remaining brood.

### 4. Removal of Infested Trees by Commercial Sale or Administrative Use

When infested trees of merchantable size are accessible, they should be removed by commercial sale or administrative use procedures. Logging of the infested material should begin immediately. Contract time limits should be set to insure rapid removal of infested trees. When only a small volume of infested merchantable material occurs in a spot, non-infested trees surrounding the spot may be marked to provide an operable cut.

The order of priority of removing beetle-infested timber from a spot should be as follows:

--Trees with nearly developed brood (later instar larvae, pupae, callow adults).

--Trees with fresh attacks and young brood (eggs, young larvae).

## 5. Chemical Control

The chemical formulation recommended for Ips bark beetle control is a ½ percent lindane spray with water as a carrier. This may be formulated from a 20 percent lindane emulsifiable concentrate at the rate of 11 pints of concentrate in enough water to make 55 gallons of spray. (Ratio of one part 20 percent lindane EC to 39 parts of water).

Dursban (Chlorpyrifos) is also registered for bark beetle control. It is available as a liquid containing 4 pounds of insecticide per gallon of concentrate. The spray is prepared by mixing 2 2/3 fluid ounces of concentrate with water to make 1 gallon or 2.1 gallons of concentrate in 100 gallons of water. Dursban is to be applied only by or under the supervision of a certified pest control operator or other trained personnel responsible for insect control programs.

Cut, limb, and buck all infested trees into workable lengths. Spray the infested bark surface to the point of runoff. A compressed air sprayer (3 gallon capacity or equivalent) is an ideal applicator. Infested logs must be turned two or three times to insure complete treatment of infested bark. Low pressure sprayers may be used to treat large accessible infestations.

The order of priority for cutting and spraying infested trees in a large spot is the same as paragraph (1) under "Removal of Infested Trees by Commercial Sale or Administrative Use". To reduce the possibility of "breakouts" every effort should be made to locate and treat all green infested trees during the chemical control operation.

Never spray trees from which Ips bark beetle brood have emerged, spraying prevents natural enemies of these beetles from completing their development.

Instructions for minimizing the adverse effects of mixing, transporting and storing pesticides, applying pesticides, and disposing of pesticide containers and excess chemicals should be obtained from the appropriate source in your agency.

### Examination of Treated Areas

Examine areas where infested trees were treated using any of the Direct Control Options stated previously, within 2 or 3 weeks after the treatment to check for additional infested trees. If additional infested trees are found, treat them as quickly as possible.

In any area where infested trees are cut, stumps adjacent to living pine trees should be treated to control or prevent Annosus root rot.

In stands that have been previously thinned or have a history of Annosus root rot, stumps should be treated with the competing fungus Phlebia gigantea (formerly Peniophora gigantea).

In stands that have no history of Annosus root rot and have never been thinned, stumps should be treated with borax at the time of cutting.

The stumps of trees infested with Ips beetles cut during the period of May through August, and below 34° N. latitude do not have to be treated with either of the above materials. Few fungal spores are formed during this period and high temperatures often kill spores that are produced. However, routine summer thinnings in areas of Ips bark beetle population buildups are not recommended.

#### B. Indirect Control Options

In addition to the direct control methods listed above, several preventive measures will help minimize Ips population buildups.

##### 1. Minimize damage to trees and site

Trees under stress are attractive to Ips beetles. When using heavy equipment for road maintenance, building site construction, or general maintenance, use care to avoid physical damage to trees, root damage, and soil compaction.

##### 2. Scatter breeding material during clearing operations

In addition to breeding in stressed trees, Ips beetles reproduce in slash from clearing operations. Scattering the slash promotes rapid dessication of the tops and limbs, making it unsuitable for beetle breeding purposes. Bolts cut from infested or uninfested trees should not be stacked against or near uninfested trees. The resinous odors may attract beetles resulting in the establishment of a new infestation.

##### 3. Do not conduct clearing operations during periods of extreme tree stress

A certain amount of Ips population buildup in slash is almost inevitable. If clearing operations are conducted when trees are stressed (drought, flooding, fire, etc.) residual trees may be attacked and killed as a result.

##### 4. Do not conduct prescribed burning during periods when excessive bark and crown scorch are likely

As evidenced by the current infestations, fire damaged timber is attractive to Ips bark beetles. Prescribed burning should be used when it is possible to accomplish the forest management objectives, but also minimize damage to the tree crowns and



cambial region. The use of backing and flanking fires as opposed to the hotter burning head fires is recommended. Winter burns when the trees are dormant are also recommended opposed to summer burns when the trees are rapidly growing.

#### 5. Removal of overmature pines

Overmature pines are attractive to Ips bark beetles because of their slow growth and their inability to "pitch out" attacking beetles. The removal through sale of overmature trees is recommended.

#### C. No Control Option

Under this option, infestations would be allowed to run their natural course until brought under control by parasites, predators, weather, or lack of suitable host material. The disadvantage of this option is that the possibility of additional tree loss exists, before natural control of the infestation occurs. Advantages in utilizing this option are: (1) no cost, and (2) no artificial disruption of the environment.

We suggest that Control Option C be used within the boundaries of the fire. Direct Control Options applied in the fire area would be economically unreasonable because of the sheer numbers of trees involved and the lack of a current market for small timber. Biologically, Direct Controls would be ineffective because of the number of dead and damaged trees. Around the perimeter or outside of the burned area, any of the Direct Control Options would be justified in controlling Ips infestations.

Ips bark beetles will continue to exist at Avon Park Air Force Range after the current infestation subsides as long as susceptible pine species are present. While these insects act as natural thinning agents in the ecosystem, any time large numbers of pines are stressed,

Trees killed by insects, diseases, fire or other causes that pose a threat to visitors, employees, or facilities should be considered hazardous and treated appropriately. Field surveillance by Avon Park Air Force Range personnel should continue to promote early detection of potential insect and disease problems.

#### ACKNOWLEDGEMENT

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## PESTICIDE PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key -- out of the reach of children and animals -- and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registration of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure intended use is still registered.

Before using any pesticide, read the label carefully.



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